CLAIMS

1. A variable function voting solenoid-operated valve apparatus useful for testing and controlling industrial process systems, the apparatus comprising:

a first solenoid-operated valve and a second solenoid-operated valve;

a bypass valve; and

a plurality of pressure sensors, including a first pressure sensor in fluid communication with said first solenoid-operated valve, a second pressure sensor in fluid communication with said second solenoid-operated valve, and a third pressure sensor in fluid communication with said bypass valve.

2. The variable function voting solenoid-operated valve apparatus of Claim 1, further comprising a logic control system, wherein said logic control system selectively enables an operator of said variable function voting solenoid-operated valve apparatus to select one of at least two discrete operational modes.

3. The variable function voting solenoid-operated valve apparatus of Claim 2, wherein said at least two discrete operational modes includes a 1 out of 1 with hot stand-by mode and a 2 out of 2 with high diagnostics mode.

4. The variable function voting solenoid-operated valve apparatus of Claim 3, wherein when said apparatus is selected to operate in a 2 out of 2 with high diagnostics mode, testing of said apparatus may be performed thereon without bypassing said apparatus prior to initiation of testing.

5. The variable function voting solenoid-operated valve apparatus of Claim 3, wherein when said apparatus is selected to operate in a 1 out of 1 with hot standby mode, testing of said apparatus may be performed thereon without bypassing said apparatus prior to initiation of testing.

6. The variable function voting solenoid-operated valve apparatus of Claim 1, wherein said first solenoid-operated valve and said second solenoid-operated valve are electrically operated and direct a pneumatic supply to a process valve actuator or direct the process valve actuator pressure to atmospheric vent.

7. The variable function voting solenoid-operated valve apparatus of Claim 6, wherein said first solenoid-operated valve and said second solenoid-operated valve are electrically operated and will direct dry instrument air.

8. The variable function voting solenoid-operated valve apparatus of Claim 6, wherein said first solenoid-operated valve and said second solenoid-operated valve are electrically operated and direct dry instrument air filtered to around a three micron level.

9. The variable function voting solenoid-operated valve apparatus of Claim 6, wherein said first solenoid-operated valve and said second solenoid-operated valve are electrically operated and direct any plant pneumatic supply.

10. The variable function voting solenoid-operated valve apparatus of Claim 1, wherein said bypass valve is actuated by a switching device.

11. The variable function voting solenoid-operated valve apparatus of Claim 10, wherein said switching device comprises a key switch.

12. The variable function voting solenoid-operated valve apparatus of Claim 1, wherein said apparatus further comprises a manifold.

13. The variable function voting solenoid-operated valve apparatus of Claim 12, wherein said manifold is comprised of aluminum.

14. The variable function voting solenoid-operated valve apparatus of Claim 12, wherein said manifold is comprised of anodized aluminum.

15. The variable function voting solenoid-operated valve apparatus of Claim 12, wherein said manifold is comprised of composite material.

16. The variable function voting solenoid-operated valve apparatus of Claim 12, wherein said manifold is comprised of steel.

17. The variable function voting solenoid-operated valve apparatus of Claim 1, wherein said apparatus further comprises an enclosed housing.

18. The variable function voting solenoid-operated valve apparatus of Claim 17, wherein said apparatus further comprises an enclosed steel housing.

19. The variable function voting solenoid-operated valve apparatus of Claim 17, wherein said apparatus further comprises an enclosed composite material housing.

20. A variable function voting solenoid-operated valve apparatus useful for testing and controlling industrial process systems, the apparatus comprising:

a first solenoid-operated valve and a second solenoid-operated valve;

a switch actuated bypass valve;

a valve manifold, wherein said first and second solenoid-operated valves and said switch actuated bypass valve are joined by said valve manifold;

a plurality of pressure sensors, including a first pressure sensor in fluid communication with said first solenoid-operated valve, a second pressure sensor in fluid communication with said second solenoid-operated valve, and a third pressure sensor in fluid communication with said switch actuated bypass valve; and

a logic control system, wherein said logic control system selectively enables an operator of said variable function voting solenoid-operated valve apparatus to select one of at least two discrete operational modes.

21. The variable function voting solenoid-operated valve apparatus of Claim 20, wherein said at least two discrete operational modes includes a 1 out of 1 with hot stand-by mode and a 2 out of 2 with high diagnostics mode.

22. The variable function voting solenoid-operated valve apparatus of Claim 21, wherein when said apparatus is selected to operate in a 2 out of 2 high diagnostics mode, testing of said apparatus may be performed thereon without bypassing said apparatus prior to initiation of testing.

23. The variable function voting solenoid-operated valve apparatus of Claim 21, wherein when said apparatus is selected to operate in a 1 out of 1 hot standby mode, testing of said apparatus may be performed thereon without bypassing said apparatus prior to initiation of testing.

24. A method of testing a first operational mode in a variable function voting solenoid-operated valve apparatus having a first solenoid-operated valve and a second solenoid-operated valve; a bypass valve; and a plurality of pressure sensors including a first pressure sensor in fluid communication with said first solenoid-operated valve, a second pressure sensor in fluid communication with said second solenoid-operated valve, and a third pressure sensor in fluid communication with said bypass valve, the method of testing comprising:

de-energizing said first solenoid-operated valve and confirming a closed state of said first pressure sensor;

re-energizing said first solenoid-operated valve and confirming an open state of said first pressure sensor;

de-energizing said second solenoid-operated valve and confirming a closed state of said second pressure sensor; and

re-energizing said second solenoid-operated valve and confirming an open state of said second pressure sensor.

25.   The method of testing a first operational mode in a variable function voting solenoid-operated valve apparatus of Claim 24, wherein said variable function voting solenoid-operated valve apparatus includes:

a first solenoid-operated valve and a second solenoid-operated valve;

a switch actuated bypass valve;

an aluminum valve manifold, wherein said first and second solenoid-operated valves and said switch actuated bypass valve are joined by said aluminum valve manifold;

a plurality of pressure sensor, including a first pressure sensor in fluid communication with said first solenoid-operated valve, a second pressure sensor in fluid communication with said second solenoid-operated valve, and a third pressure sensor in fluid communication with said switch actuated bypass valve; and

a logic control system, wherein said logic control system selectively enables an operator of said variable function voting solenoid apparatus to select one of at least two discrete operational modes.

26. A method of testing a second operational mode in a variable function voting solenoid-operated valve apparatus having a first solenoid-operated valve and a second solenoid-operated valve; a bypass valve; and a plurality of pressure sensors including a first pressure sensor in fluid communication with said first solenoid-operated valve, a second pressure sensor in fluid communication with said second solenoid-operated valve, and a third pressure sensor in fluid communication with said bypass valve, the method of testing comprising:

confirming an open state of each of said first pressure sensor and said second pressure sensor;

de-energizing said first solenoid-operated valve and confirming a closed state of said first pressure sensor;

re-energizing said first solenoid-operated valve and confirming an open state of said first pressure sensor; and

de-energizing said second solenoid-operated valve and confirming a closed state of said second pressure sensor.

27. The method of testing a second operational mode in a variable function voting solenoid-operated valve apparatus of Claim 26, wherein said variable function voting solenoid-operated valve apparatus includes:

a first solenoid-operated valve and a second solenoid-operated valve;

a switch actuated bypass valve;

an aluminum valve manifold, wherein said first and second solenoid-operated valves and said switch actuated bypass valve are joined by said aluminum valve manifold;

a plurality of pressure sensors, including a first pressure sensor in fluid communication with said first solenoid-operated valve, a second pressure sensor in fluid communication with said second solenoid-operated valve, and a third pressure sensor in fluid communication with said switch actuated bypass valve; and

a logic control system, wherein said logic control system selectively enables an operator of said variable function voting solenoid-operated valve apparatus to select one of at least two discrete operational modes.

28. The variable function voting solenoid-operated valve apparatus of Claim 21, wherein said apparatus is used to test the performance of the safety action, a partial movement of the process valve can be executed to prove the process valve is capable of actuating to the safe state, without undesired modification or disruption of the plant process system being monitored, while providing diagnostic information on the safety action.